



COLONY OF SINGAPORE

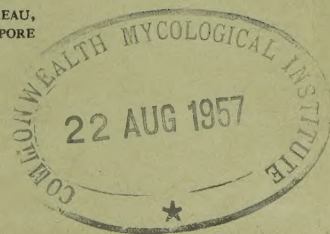
ANNUAL REPORT OF THE BOTANIC GARDENS DEPARTMENT FOR 1956

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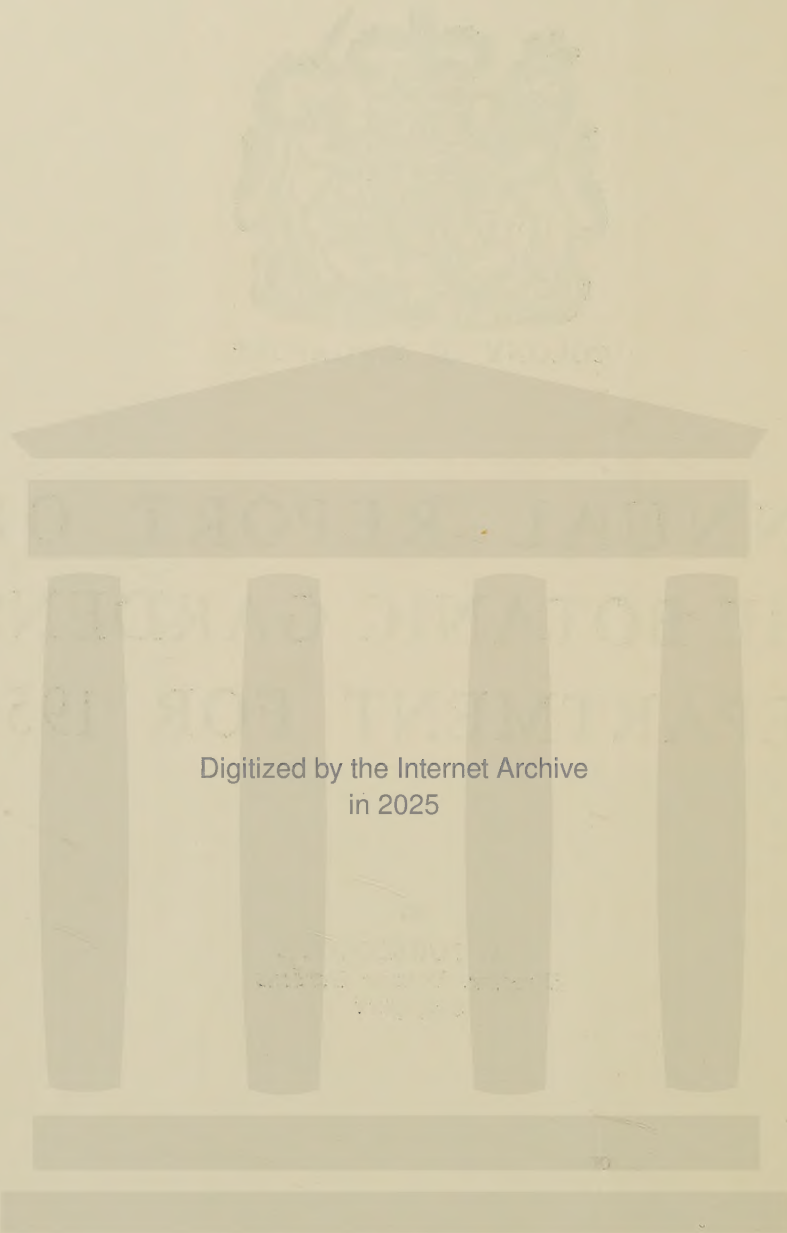
ANNUAL REPORT OF THE BOTANIC GARDENS DEPARTMENT FOR 1956

BY

J. W. PURSEGLOVE
*Director, Botanic Gardens
Singapore*

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I. GENERAL

THE PROGRESS reported last year was maintained in 1956. There were no staff changes, but the Government's Malayanisation policy introduced towards the end of the year will result in changes in 1957. The first research worker financed from Colonial Development and Welfare Funds arrived in December.

2. It is with deep regret that the death was recorded on the 24th October, 1956 of Mr. H. N. Ridley, C.M.G., F.R.S. in his one hundred and first year. Mr. Ridley had been Director of the Singapore Botanic Gardens from 1888-1912 and was "the father of Malaya's rubber industry." The Gardens had celebrated Mr. Ridley's centenary on the 10th December, 1955, as was reported in paragraphs 43-47 of the 1955 Annual Report.

II. STAFF

3. In a small department such as the Botanic Gardens, difficulty is experienced when senior members of the staff go on vacation leave, as those officers remaining must take over additional duties and responsibilities to those which they normally perform. Mr. J. Sinclair, Keeper of the Herbarium was away from Singapore from 29th February-13th October on vacation leave in Europe. Although no study leave was taken, Mr. Sinclair spent a considerable time working at the Herbaria of Florence, Munich, Geneva, Leiden, Kew, the British Museum and Edinburgh. Dr. C. X. Furtado, Botanist, was in charge of the Herbarium during Mr. Sinclair's absence. Mr. J. W. Ewart, Curator, left for annual vacation leave in New Zealand on 26th January and returned on 10th March. Mr. H. M. Burkill acted as Director from 15th May-13th June, while Mr. Purseglove was away on duty in Sarawak.

4. Mr. Chew Wee Lek, a graduate of the University of Malaya, was appointed Botanist on 1st October. Mr. Chew will proceed overseas for post-graduate study in 1957; in the meantime he will carry out preliminary research in Singapore. Dr. C. X. Furtado, a re-employed pensioner continued in the post of Botanist, the title having been changed from that of Assistant Botanist. Dr. Furtado has agreed to remain on the staff until Mr. Chew returns to Singapore in 1959.

5. The post of Assistant Librarian was up-graded to Librarian, but was vacant for most of the year, until Mrs. Lynas was appointed temporary Librarian on 1st October.

6. Mr. A. G. Alphonso, Horticultural Assistant, returned to Singapore on 2nd December after two years' training at the Royal Botanic Gardens, Kew, where he obtained the Kew Diploma.

7. The British Empire Medal was conferred by Her Majesty the Queen in the Birthday Honours on Inche Ahmad bin Hassan, who has now completed fifty-five years service in the Department. Inche Ahmad, who was first employed by Mr. Ridley as a Plant Collector in 1901, has rendered meritorious service to the Botanic Gardens during his long period. He is still very hale and hearty and his great knowledge of local plants is a very valuable asset to the Gardens.

8. There was no change in the office staff during the year. On the field side, Inche Ngadiman bin Haji Ismail was promoted from Plant Collector to Head Ranger, Nature Reserves on 1st January and the three new appointments of Rangers to supervise the Reserves were filled on 1st June. Inche

Mohamed Shah bin Haji Mohamed Nur was appointed Plant Collector on 1st January, having spent the previous year as a daily-paid labourer learning this work.

9. Mr. Purseglove attended a Symposium on the "Vegetation of the Humid Tropics" arranged by U.N.E.S.C.O. in Ceylon in March. The Director acted as Chairman of the Committee on Animal and Vegetable Life and Resources of the Pan-Malayan Scientific Advisory Council during the year. He was Chairman of the Singapore Branch of the Malayan Nature Society, Vice-President of the Gardening Society, and a member of the Court of the University of Malaya.

10. A list of the staff of the Botanic Gardens, Division I-III, is given in Appendix I.

III. METEOROLOGICAL

11. A new meteorological station was set up in the Orchid Enclosure in January. The Singapore Meteorological Office very kindly supplied the following instruments:— maximum and minimum thermometers, wet and dry bulb thermometers, recording thermograph, recording hygrograph, rain gauge, recording rain gauge which records density of precipitation, sunshine recorder, solar radiation thermometer, grass minimum thermometer, three earth thermometers for the depths of four inches, one foot and four feet and a Stevenson screen. It was thus possible to extend considerably the data on local climatic conditions, which is of great importance to the study of plant growth and especially the time of leaf fall and flowering. The records for the new station taken at 8 a.m. are given in Appendix III, while those for the old station, where readings continued at 9.30 a.m., are given in Appendix II. These may be summarized as follows:—

			<i>Gardens' Office</i>	<i>Orchid Enclosure from 21-1-56</i>
Total Rainfall	..	..	105.17 in.	100.25 in.
Highest Fall in 24 hours	..	..	4.33 in.	4.00 in.
No. of days on which rain fall	..	..	201	202
Average Rainfall 1914-56	..	..	100.00 in.	—
Mean Maximum Temperature	..	..	86.3°F.	85.7°F.
Highest Maximum Temperature	..	..	92.8°F.	91.8°F.
Mean Minimum Temperature	..	..	74.1°F.	73.3°F.
Lowest Minimum Temperature	..	..	70.2°F.	69.0°F.
Mean Temperature Dry Bulb	..	..	80.1°F.	75.4°F.
			at 9.30 a.m.	at 8 a.m.
Mean Temperature Wet Bulb	..	..	76.4°F.	74.9°F.
			at 9.30 a.m.	at 8 a.m.
Mean Relative Humidity	..	..	83.5%	96.1%
			at 9.30 a.m.	at 8 a.m.
Mean Minimum Grass Temperature	..	..	—	70.7°F.
Mean Earth Temperature 4 in.	..	..	—	80.3°F.
Mean Earth Temperature 1 ft.	..	..	—	82.6°F.
Mean Earth Temperature 4 ft.	..	..	—	83.1°F.
Mean Daily Hours Sunshine	..	..	—	4.2
Mean Solar Radiation	..	..	—	137.3°F.

12. The rainfall for the year was slightly above the average, but was fairly typical of this seasonless climate. July and November were unusually wet. Although the two stations are only about a quarter of a mile apart, the daily readings show some variation, as storms in Singapore are often exceedingly local. Three graphs from the hygrograph are figured in Plate I. During days of heavy rain when the sky is continuously overcast, humidity remains at saturation point, while in fine sunny weather humidity gradually drops to 60–70 per cent at mid-day and gradually rises during the afternoon to over 90 per cent during the night.

13. The total monthly and annual rainfall at the Gardens from 1914, when the first records were begun, until 1956 are given in Appendix IV, as well as the average for this period. Many of these figures have not been published previously and those for 1942–6 are of particular interest as they are the only records now available for Singapore during the Japanese interregnum.

IV. BOTANICAL WORK AND HERBARIUM

(i) COLLECTING

14. With the Keeper of the Herbarium away for seven and a half months on vacation leave and being fully occupied for the rest of the year on his study of Malayan Myristicaceae, collecting by members of the staff was confined largely to the Director and Assistant Director. Besides local collecting on day trips, Mr. Burkill collected in the following areas:—Pulau Satumu, Biola and Senang, 30th March–2nd April and 3rd–7th August (186 numbers); Horsburgh Light, South China Sea, 27th–28th June (27 numbers); Pulau Pisang, Southern end of Malacca Straits, 6th–7th July (31 numbers); Port Dickson, Negri Sembilan, 26th August and 11th–15th September (66 numbers); on local leave at Cameron Highlands, Pahang, 27th August–10th September (152 numbers); Pulau Angsa, Central Malacca Straits, 18th–22nd November (78 numbers); Sungei Buloh, Selangor, 23rd–26th November (103 numbers). On many of these excursions Mr. Burkill collected marine algae as well as land plants. His visit to the Cameron Highlands included the ascent of Gunong Batu Brinchang, 6,666 feet, now made accessible by a road to the radio station at the summit, where European Gorse (*Ulex europæus*) is now naturalised. Also here was found *Polygonum paniculatum*, a new record for Malaya. In all Mr. Burkill collected 733 numbers, of which 354 were algae.

15. The Director made small collections at Mersing and Gunong Pulai in Johore and at Fraser's Hill in Pahang, while Mr. Sinclair also made a small collection from Kuantan, Temerloh, Fraser's Hill and Malacca from 19th–22nd October.

16. Mr. Puresglove visited Sarawak for the period 15th May–13th June. The first week was spent making a preliminary investigation of the flora of the newly-established Bako National Park at the mouth of the Sarawak River, where there is extensive heath woodland on the padang, as well as lowland forest on karenga sands. On the very acid, wet, shallow podsolised sands of the padang, overlying the sandstone rock the heath-like shrubs and small trees of *Styphelia malayana*, *Bæckia frutescens*, *Ploiarium alternifolium* and *Dacrydium beccarii* were encrusted with epiphytic myrmecophilous plants of *Hydnophytum formicarium*, *Myrmecodia tuberosa*, *Pachycentria glauca* and *Dischidia rafflesiana*. A small sundew, *Drosera spatulata*, a new record for Sarawak, was abundant on the peaty soils by the tea-coloured streams, as were *Utricularia* spp. The sundew which is normally confined to open mountain heaths, was growing at 300 feet above sea level. An attractive orchid,

Paphiopedilum hookeræ, was plentiful on Pulau Lakei. Two species of *Loxocarpus*, probably new to science, were discovered in the karenga forests, as well as other novelties.

17. From Bako Mr. Purseglove returned to Kuching and from there proceeded by launch to Tatau, then by *prahu* up the Tatau River to Sana on the Sungei Tau and from there on foot to the Tau Range of mountains, where ten days were spent in little-known country, hitherto unvisited by botanists. As might be expected, many interesting plants were obtained, including a number of known species of which there are no specimens in the Singapore Herbarium, e.g. *Beccarianthus pulcher*, an attractive shrub with large deep pink flowers; new records for Borneo, e.g. *Ficus stricta*, a strangling fig 120 feet high; and many plants which cannot be identified in Singapore, which will include a number of new species, e.g. *Microcasia* sp. nov. One of the most spectacular plants collected was *Rhododendron* sp. (Purseglove 5440), a shrub 5 feet in height growing as an epiphyte 30 feet above ground level on a tree along the Tatau River. This was the only specimen seen. It had an inflorescence of eight very attractive flowers, nearly 4 inches in diameter and salmon pink in colour with a white star in the centre. A living plant was brought back to Singapore and has so far survived. It is certainly one of the most attractive *Rhododendrons* so far discovered in the lowland tropics. Herbarium material has been sent to Dr. Sleumer of Leiden for determination.

18. In all the Director collected 616 numbers in Sarawak during this visit. With an average of five or six duplicates per number, a total of over 3,000 specimens was brought back to Singapore for naming, incorporation in the Herbarium and for distribution. In addition, a fair number of living plants and seeds were brought back for trial in the Gardens. The Chief Secretary of Sarawak, the Curator of the Sarawak Museum, the Honorary Keeper of the Herbarium and the Conservator of Forests and his staff are thanked for supplying launch transport and for other assistance, without which the expedition would not have been possible.

19. Some new records for individual states of the Malay Peninsula were obtained, as well as a few plants entirely new to Malaya. A lily-like herb collected near Kuala Lumpur by Mr. J. Reid of the Institute for Medical Research was identified by Mr. Sinclair while at Kew as *Chlorophytum laxum*, which has a wide distribution in India, Siam and North Australia, but was previously unknown in Malaya. Another new record was *Canthium cochinchinense*, which had been collected by Mr. Sinclair in Trengganu. Two orchids, *Goodyera hispida* and *Bulbophyllum concinnum*, obtained by Mr. E. F. Allen of the Federation Department of Agriculture on a limestone hill in the Templer National Park were new records for Selangor.

(ii) EXCHANGE AND LOAN OF HERBARIUM SPECIMENS

20. The routine work of drying, poisoning and mounting specimens, as well as the repair of existing sheets, was continued throughout the year. The number of sheets mounted and incorporated in the herbarium was 1,196, a reduction over the previous year, due to the long delay in supplying new mounting paper from Britain and also a lack of cupboard space. The eight cabinets received towards the end of the year are insufficient to house all the material awaiting incorporation and more cabinets are urgently required.

21. The number of specimens received in exchange for duplicates sent out and those donated was 6,768, as compared with 2,451 in 1955. The following institutions and individual are thanked for sending this valuable material:—the Auckland Museum; the British Museum; the Forestry Departments of Brunei, Sarawak, British North Borneo and New Guinea, the Forest

Research Institute, Kepong; the Kebun Raya Bogor; the Rijksherbarium, Leiden; the Arnold Arboretum; H.E. the British Ambassador to Laos—Lord Talbot de Malahide and his successor Mr. L. G. Holliday; Mr. G. H. Pickles—a member of the 1955–6 Oxford University Expedition to Sarawak; Mr. E. F. Allen and Dr. J. Dore of the Federation of Malaya's Agricultural Department; Mr. J. A. le Doux of Kota Tinggi; Mrs. B. E. G. Allen; and Professor H. B. Gilliland. Many gaps in the collection have been filled by these specimens exchanged and donated and they are most useful to the staff engaged on the revision of individual families.

22. The number of herbarium duplicates distributed from the Gardens to other scientific institutions was the highest for many years, namely 5,397 specimens, compared with 2,167 in 1955. Many of these were collected by the Director in Sarawak. The following are the institutions to which material was sent:—the Royal Botanic Gardens, Kew; the British Museum; the Edinburgh Royal Botanic Garden; the Rijksherbarium, Leiden; the Museum National d'Histoire Naturelle, Paris; the Arnold Arboretum, U.S.A.; the National Museum, Manila; the Forestry Departments of Bangkok and North Borneo; the Forest Research Institutes of Kepong and Dehra Dun; the Departments of Agriculture of Bangkok and Brisbane; the Sarawak Museum and the Marine Biological Station, Anglesey. Sorting began towards the end of the year of the very large number of duplicates of specimens collected over the past thirty years by the Gardens' staff, but which had not been named specifically at the time. Wherever possible these are now being named, except for undescribed species, and they will be distributed to other herbaria on an exchange basis in 1957.

23. A total of 4,525 specimens was sent on loan to the authors of *Flora Malesiana* at Kew, Leiden and Bogor, as against 4,903 in 1955. Many specimens which had been on loan previously were returned correctly annotated, thus enhancing considerably their practical value. The number of specimens received on loan by the Herbarium staff was 577 and came from the Herbaria of Bogor, Stockholm, Uppsala and Leiden, to whom our thanks are due. They consisted of palms for Dr. Furtado and Myristicaceæ for Mr. Sinclair. Arrangements were made to borrow specimens of Myristicaceæ from other leading world herbaria and these will arrive in 1957.

24. In addition to the above exchange and loans, living plants, seeds and spirit material were sent at the request of botanists in other countries for special study. The fullest co-operation continued with the Botany Department of the University of Malaya and much material was provided for class-work and research.

(iii) CURRENT RESEARCH

25. Mr. Sinclair, Keeper of the Herbarium, continued his study of Malayan Myristicaceæ. As a result of his studies at the herbaria of Florence, Munich, Geneva, Leiden, Kew, the British Museum and Edinburgh during vacation leave, he gained much information which was not available in Singapore and was able to make many additions and corrections to his original manuscript. The Directors of these herbaria are thanked for their generous help and hospitality to Mr. Sinclair, who benefited greatly from their advice and discussions. Special thanks are due to Professor C. G. G. J. van Steenis of Leiden, the founder and editor of the *Flora Malesiana*. Mr. Sinclair extended his study to the Myristicaceæ of the whole of the Malaysian region. Opportunity was also taken to determine other plants which it had been impossible to name satisfactorily in Singapore.

26. Dr. Furtado, Botanist, continued his study of Malaysian palms. He also sorted and named large collections of plants from Borneo and New

Guinea, as well as smaller collections from Malaya and Laos, which will now be incorporated into the Herbarium. In the course of this work he took the opportunity to indicate on the herbarium specimens the publications in which they and their duplicates had been cited. In this way many specimens from Elmer's Borneo collections were named, correcting some names and indicating isotypes. Opportunity was also taken to name as far as possible many unnamed specimens already incorporated into the herbarium in previous years. He answered many queries from the Police, Chemistry, Customs and Agricultural Departments of the Federation of Malaya and Singapore, as well as other bodies and individuals and named specimens of plants and plant fragments submitted.

27. The Director completed his determinations of over 1,100 numbers collected by him in Sarawak in 1955-6, while the Assistant Director named many of his Malayan specimens.

28. Mr. Burkill, the Assistant Director, sorted and arranged the algological collection, comprising 1,071 sheets, according to Fritch's system of classification. Many of the original collections of Setchell and Gardner are represented by co-type sheets. A marine green algæ collected by Mr. Purseglove at Mersing was found to be *Acetabularia crenulata*, a new record for Malaysia. Apart from this record and one from Ceylon, this algæ has only been collected in the Caribbean region.

29. Mr. Chew Wee Lek, Botanist, has begun a taxonomic study of certain Malayan genera of Moraceæ.

30. Dr. G. A. Prowse, Botanist/Algologist of the Malacca Fish Culture, Research and Training Institute continued his research on Malayan fresh-water algæ at the Botanic Gardens until he transferred to the new station at Malacca in May. He made many interesting discoveries among the algæ in the Gardens' lake and elsewhere on the Island.

31. Dr. P. B. Tomlinson, who spent a year at the University of Malaya and the Gardens studying the systematic anatomy of palms and Musaceæ, left in June. He has now been appointed to the staff of Achimote University College, Gold Coast. Mr. T. C. Whitmore, a Ph.D. student of Cambridge University, arrived in December. He is receiving a Colonial Development and Welfare Grant and will study the anatomy of the bark of Diptero-carpaceæ in relation to taxonomy as part of his work for his doctor's thesis.

32. The Director co-operated with Dr. Bryce Douglas and Dr. Kiang Ai Kim of the University of Malaya, who are carrying out a phytochemical survey of Malayan plants. Dr. Bryce Douglas, a Visiting Research Associate of the Chemistry Department of the University of Malaya, arrived in September and is to spend two years in Singapore financed by the Smith, Kline and French Laboratories of Philadelphia. The preliminary screening for alkaloids has already produced some interesting results.

V. HORTICULTURAL WORK

(i) GENERAL

33. The Gardens were kept in good condition during the year. Good service was obtained from the motor mowers, but during periods of prolonged wet weather the heavy Dennis mowers could not be used. It is hoped that use can be made of the Hayter mowers on soft ground. Much of the time of the general labour force was occupied in clearing away uprooted trees. Some of these were old and moribund, but others were in vigorous growth, the damage usually occurring during strong gusts of wind when the

soil was saturated with rain. Composting was continued on the same scale as last year. Unfortunately the compost heaps on the various lawns provided an ideal breeding place for the Rhinoceros Beetle (*Oryctes rhinoceros*) which is causing so much damage to coconuts and other palms in Singapore. It is hoped that by collecting and destroying the larvæ when the heaps are turned and examined every six weeks, together with the use of insecticides, that some measure of control will be possible. It was found that breeding was diminished when grass or other vegetation had grown on the heaps.

34. Advantage was taken of the unusually low level of the lake during the construction of the retaining wall to root out the lotus (*Nelumbium speciosum*), *Hydrilla ovalifolia* and *Enhydrias angustipetala* which threatened to swamp the water lilies and other water plants. The Sago palms near the main gate on lawn A were cut back and the thicket round the lake outlet was cleared. Several clumps of bamboo and trees of *Eugenia grandis* and *Fagraea fragrans* were removed from the lake edge on lawn F to permit a vista across the lake from lawn J. The trees overhanging Cluny Road and Tyersall Avenue were cut back to the boundary. The quality and quantity of the pot plants have improved greatly since their transfer to the orchid enclosure.

35. Three large round beds were made on the bandstand terrace above the tea kiosk and planted with *Duranta ellisii*, *Cassia auriculata* and *Stenolobium stans*. Other new beds included *Clerodendron paniculatum* to the east of the pergola, *Calliandra emarginata* at the junction of Lower Ring Road and Office Gate Road and *Randia macrantha* under-planted with *Orthosiphon stamineus* above the sun-dial terrace. Sections of seven different hedge plants were planted alongside the orchid enclosure for trial and demonstration purposes; they were *Acalypha siamensis*, *A. sanderiana*, *Cordia cylindristachya*, *Ehretia microphylla*, *Eranthemum malaccense*, *Mussaenda luteola* and *Randia spinosa*. Borders faced with dressed coral were constructed along both sides of the pergolas at the plant house and plants bedded out in them include *Begonia coccinea* vars., *Citharexylum quadrangulare*, *Cuphea ignea*, *Gloxinia maculata*, *Lantana camara*, *Nepenthes ampullaria*, *N. gracilis*, *Rhododendron javanicum* × *indicum*, *Rhæa discolor* and *Strobilanthus dyerianus*. New creepers planted on the pergola were *Raphistemma pulchellum*, *Stephanotis floribunda* and *Urceola brachysapala*. The creeper *Camænsia maxima*, transferred to a more exposed position in 1955, has flowered freely during the year.

36. The most notable introduction during the year was the Bougainvillea Golden Glow, with apricot coloured flowers, which has grown and flowered well. Among the species new to the Gardens planted out during the year were *Podocarpus koordersii*, *P. teysmanii* and *Talauma hodgsonii* on lawn C, an hermaphrodite nutmeg (*Myristica fragrans*) on lawn D, *Pterocarpus echinata*, *P. rohrii* and *P. vidalianus* on lawn E, and *Amorphophallus titanum* on lawns T and X. Some of the foliage plants, including species new to science, introduced by the Director from Sarawak, show promise. Losses occurred in the Gardens during the year, but did not include any species which are irreplaceable.

(ii) ORCHIDS

37. The Gardens' collection of orchid species and hybrids, which were transferred to the new orchid enclosure early in 1955, continued to show better growth and flowering than on the old site at the Director's house. By the end of 1956 all the orchid seedling houses had also transferred to the new enclosure and the seedlings have benefited, as the site is more open and permits a better circulation of air. It has also been possible to dispense with the wire-netting round the houses, as the monkeys have learnt to respect

the electric fence. By concentrating all the orchid work in the one area, more adequate supervision is possible, the time and labour of those tending the orchids are saved, the transport of seedlings is reduced and the orchids are more secure. The latter is extremely important because of the large number of orchid thefts which has occurred in Singapore during the year. Private growers have lost many valuable plants, while the Gardens lost 36 seedlings of a valuable and promising cross before the seedlings were transferred to their new quarters. Three of our best *Vanda Tan Chay Yan* plants and two *Dendrobiums*, which were on display in the plant house, were stolen in August. The police have not been able to trace the culprits, but it is obvious that those responsible have a considerable knowledge of orchids. Because of these thefts it is no longer possible to display valuable orchids in the plant house and so the public is deprived of seeing them at close quarters. This is particularly disappointing to the many tourists who visit the Gardens, some of whom come specifically to see the orchids. It is regretted that our best orchids cannot be displayed to the public until such time as the Gardens are enclosed by security fence and new gates provided or until the plant house is rendered thief-proof.

38. The simplified technique of planting the *Arachnis*, *Arandas*, the *terete* and *semi-terete* *Vandas* and other orchids normally grown in beds, is proving very satisfactory. This consists of merely stripping off the turf, driving in the stakes about 15 inches apart, tying the plants to the stakes so that their roots just rest on the surface of the soil and then building a mixture of half-rotted compost and manure round the plants to a height of 9 inches. By using this method no digging is done at all and the plants seem to thrive equally well, thus effecting a great saving in cost, time and compost. The cultivation of the seedlings in the sterilised medium with Vacin's formula in the flasks in the laboratory was continued. Experiments were begun using coconut water (the liquid inside the nuts), both from immature and mature nuts, with the medium and it has produced very spectacular results. It is known that the coconut water contains a growth-promoting substance and it has speeded up the early growth of the seedlings to a remarkable degree. These experiments are continuing.

39. Many exchanges of orchids were arranged with institutions abroad, as well as local growers. A large selection of *Vandas* and *Dendrobiums* was received on an exchange basis from Messrs. William Kirch of Honolulu. Messrs. T.M.A. Orchids of Singapore gave a selection of their new seedlings in exchange for some of ours. Among the plants received were a good variety of *Aranthera* James Storie, *Dendrobium* Edythe Pung, D. Grace Goo, D. Gouldii, *Vanda cærulea*, *Vandænopsis* Khoo Kay Ann, V. Prosperitas and *Vandanthe* Colorsan. With more orchids of Hawaiian origin in the collection, especially those with *Euanthe sanderiana* strain in them, and crossing these with our good Singapore hybrids, some outstanding new hybrids should be produced.

40. During the year 240 crosses were made, of which 88 produced seeds. These have now been sown. The number of new orchid hybrids which flowered in 1956 was 48 and many of these have now been registered. They include the following:—*Arachnis* Capama (*A. Maggie Oei* × *A. breviscapa*), A. Maroon Maggie (*A. Maggie Oei* × *A. flos-aris* var. *insignis*), Aranda Amy Braga (*Vanda* Gilbert Triboulet × *Arachnis* Maggie Oei), A. Anne Braga (*Arachnis hookeriana* × *Vanda cooperi*), A. Bertha Braga (*Vanda tricolor* × *Arachnis* Maggie Oei), A. Eng Lan (*Arachnis* Maggie Oei × *Vanda* Rose Marie), A. Freckles (*Arachnis* Ishbel × *Vanda dearei*), A. Louise Wong (*Arachnis* Maggie Oei × *Vanda sumatrana*), A. Mauve Star (*Arachnis hookeriana* var. *luteola* × *Vanda* Flammerolle), A. Myrna Braga (*Arachnis* Ishbel

× *Vanda merrillii*), A. Pink Pearls (*Arachnis hookeriana* var. *luteola* × *Vanda* Gilbert Triboulet), Arandanthe Wendy Scott (*Arachnis hookeriana* var. *luteola* × *Vandanthe rothschildiana*), Aranthera Anne Black (*Arachnis* Maggie Oei × *Renanthera coccinea*), A. Bloodshot (*Arachnis* Ishbel × *Renanthera coccinea*), Dendrobium Abigail (D. Pauline × *D. veratrifolium*), A. Ang Swee Kim (D. Pauline × D. Tan Chye Siam), D. Kehaulana Ayau (D. Bali × *D. phalaenopsis*), D. Liliha (*D. phalaenopsis* × D. Pauline), D. Mustard (D. Ursula × D. Champagne), D. Purple Veins (D. Varsity × *D. phalaenopsis*), D. Syaj (D. Caesar × D. Constance) D. Tumphal (*D. arcuatum* × *D. phalaenopsis*), D. Yellow Curls (D. Champagne × *D. undulatum*), Ridleyara Fascad (Aranda Eileen Addison × *Trichoglottis fasciata*), Vanda Memoria Alex Donald (V. Josephine van Brero × V. Prolific), V. Rubella (V. Ruby × V. Prolific), Vandænopsis Kapden (Vanda Kapoho × *Phalaenopsis denevei*), V. suavi (*Vanda tricolor* × *Phalaenopsis denevei*), Vandanthe Kewalo (Vandanthe Ellen Noa × *V. luzonica*), V. Manisaki (Vanda Memoria T. Iwasaki × Vandanthe Manila).

In the above list the female parent is always given first, the species used are given in italics and hybrids in ordinary type.

41. Of the above hybrids Ridleyara Fascad is undoubtedly the most interesting and is the first trigeneric cross to be raised at the Gardens. It is also the first cross to flower in which Aranda was used as a parent; most other Arandas do not produce viable seed. Its parentage is as follows:—*Vanda* Kapoho × *Arachnis* Maggie Oei (both hybrids)=Aranda Eileen Addison × *Trichoglottis fasciata*=Ridleyara Fascad. It is named in honour of Mr. H. N. Ridley and this was some of the last information to enter his consciousness before he died. One of the most promising hybrids to flower during the year was Aranthera Anne Black, named in honour of Lady Black, wife of H.E. the Governor of Singapore. It is similar to A. James Storie, but has larger flowers, longer and denser sprays and is very free flowering. Aranda Myrna Braga should prove useful for the cut flower market. It has long sprays of yellow flowers heavily mottled with rich brown; it is very free flowering and may produce as many as five sprays simultaneously. Arandanthe Wendy Scott is a very fine hybrid with flowers of an unusual shade of mauve pink. The first seedling of the cross to flower has proved to be the best and flowers every two months, bearing two to three spikes. The two best new Dendrobiums are D. Purple Veins, which shows considerable variation, but the best seedlings are medium purple with prominent darker veins, and D. Ang Swee Kim, of which one seedling has the darkest purple flowers yet raised in Singapore. The best Vanda-type hybrids are Vanda Memoria Alex Donald which is free flowering and has large heads of peach coloured flowers and Vandanthe Kewalo which has similar colouring to *Vanda luzonica*, but without the shy blooming habit and twists in the flowers of the parent. This cross was first made in Hawaii, but has been raised subsequently at the Gardens.

42. The Malayan Orchid Society was resuscitated during the year and is now producing a number of the *Malayan Orchid Journal*, in which descriptions of the new orchid hybrids will be published. During the past two years these have appeared in the *M.A.H.A. Magazine* of the Malayan Agri-Horticultural Association.

(iii) SUCCULENTS

43. Although the succulent collection was not greatly enlarged in number of species, many of the established plants were grown to a larger size and were propagated. Aloes and Agaves, which at the beginning of the year were

in 4-inch pots, were transferred to 8-inch pots and have grown remarkably well. Although a second succulent house was built, this is now full and more accommodation is required. The keen interest among local growers continued and once again it was found impossible to meet all the demands for the purchase of succulents.

(iv) PLANT SALES AND EXCHANGE

44. The revenue from the sale of plants during the year was \$27,245, compared with \$22,187 in 1955 and an increase of 55 per cent over the 1953 sales. The major proportion of the revenue of \$22,759 came from the sale of orchids, comprising 352 plants, 558 cuttings and 2,536 seedlings, a total of 3,446. A total of 426 succulents was sold for \$478, while 25,666 sales of other plants produced \$4,008, a reduction over the previous year. Some 3,198 plants and cuttings were supplied free to Government institutions and schools.

45. Planting material distributed on an exchange basis, mainly to botanical institutions overseas, consisted of 368 packets of seeds and 102 plants and cuttings. In return the Gardens received 575 packets of seeds and 322 plants and cuttings, including gifts. Those institutions and individuals who provided this valuable materials are listed in Appendix V and we are most grateful to them, while those to whom we sent seeds and plants are given in Appendix VI. The number of pot plants loaned to Government Departments during the year was 1,643.

VI. ADVISORY WORK

46. Numerous schools and other Government institutions were visited during the year and advice, plans and planting material were supplied free of charge. The assistance of the Department is constantly being solicited in this way, a task which it does its best to fulfil. In addition to these, many requests were received from private individuals seeking advice. The Department has co-operated fully with the Public Works and other Departments and the principal work which it has planned and provided planting material for is as follows:—Nicoll Drive, Buona Vista Park, Pasir Panjang Park, the dual carriage way on Bukit Timah Road, the Land Development Unit at Tanjong Rhu, the Police Cantonment at Mount Vernon, the new Probationary Nurses Hostel at the General Hospital, the Teachers Training College, Paya Lebar Airport, New Fire Brigade and Ambulance Station at Bukit Timah Road, Coroner's Court in Outram Road, No. 10 Ridley Park, Tan Tock Seng Hospital, Fort Canning Park and Raffles' Statute in Empress Place. Details of this work and the lists of plants provided would take up too much space and be repetitive. Two examples only will be quoted. In addition to the 370 trees provided for Nicoll Drive in 1955 the following were also supplied in 1956:—48 Royal Palms, 44 *Terminalia catappa*, 17 Tamarind, 6 *Peltophorum* and 2 *Adinantha*. The following were provided for the Police Cantonment at Mount Vernon:—31 *Acacia*, 17 *Millettia*, 12 *Adinantha*, 12 Madras Thorn, 11 Rain Trees, 11 Yellow Flames, 11 *Filicium*, 11 Mahoganies, 10 *Muntingia*, 9 *Casuarina sumatrana*, 8 *Eugenia grandis*, 8 *Andira* and 7 *Plumeria*. It can thus be seen that the Gardens Department continues to play a very active part in planning the amenities of the Colony and in helping to make it as beautiful as possible.

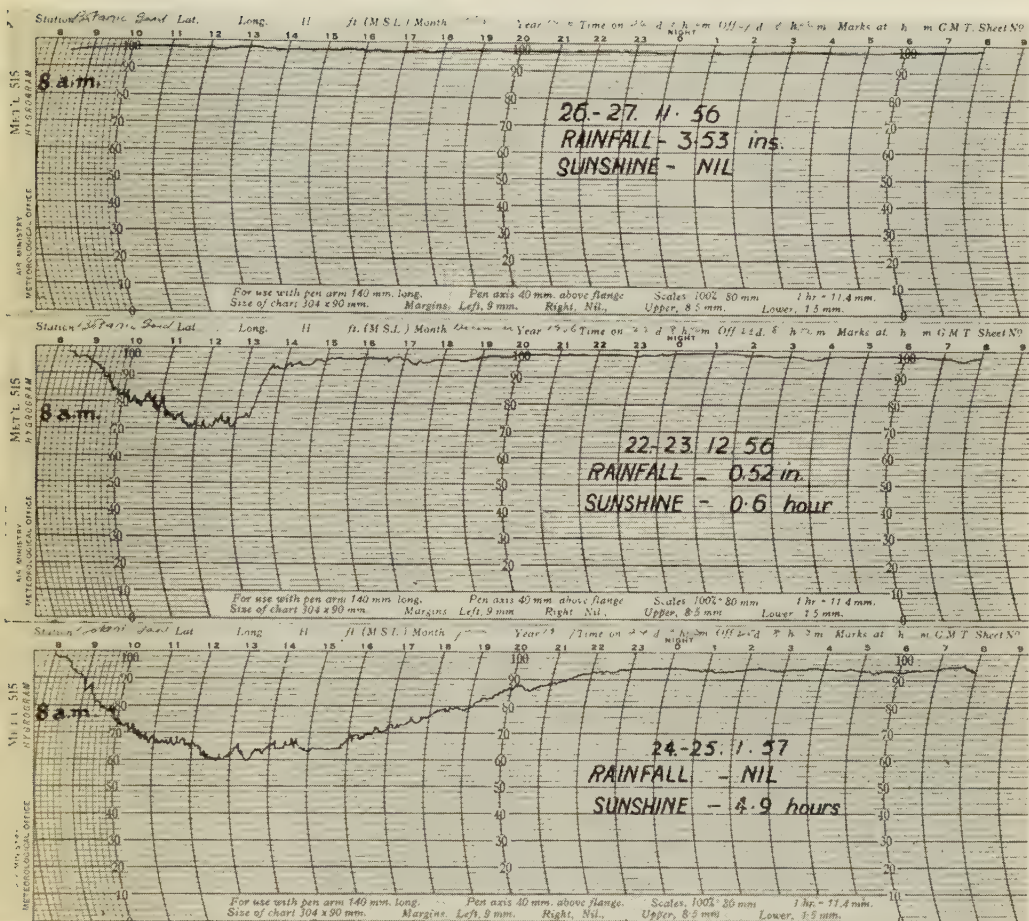


PLATE I—Daily humidity charts at the Singapore Botanic Gardens.



J W Purseglove

PLATE II—*Ploiarium alternifolium* with epiphytic ant-plants in the Bako National Park, Sarawak.



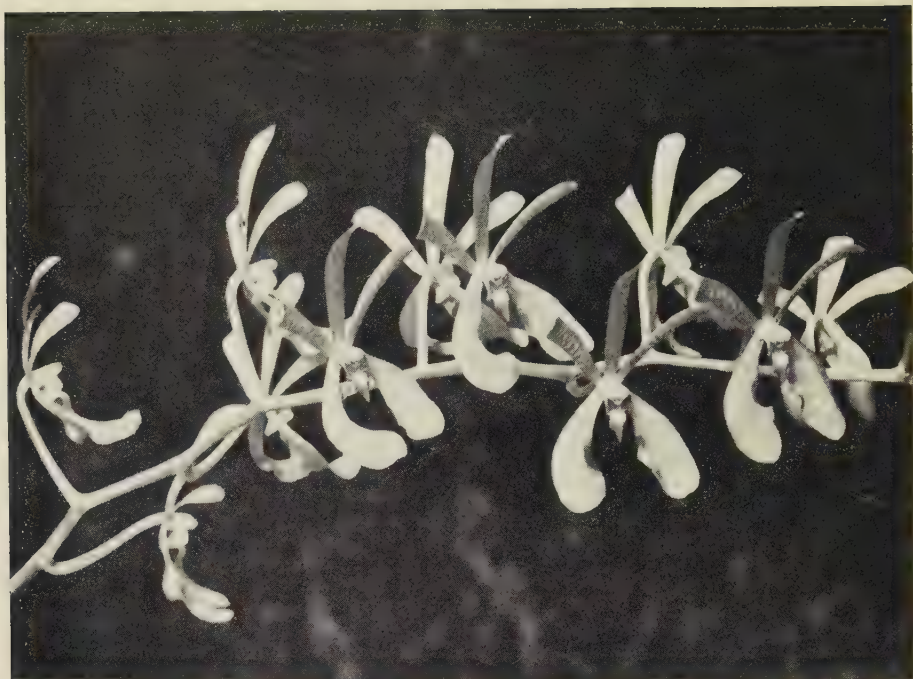
J. W. Purseglove

PLATE III—Group of epiphytic ant-plants growing on *Cratoxylon glaucum* in the Bako National Park. They include *Hydnophytum formicarium*, *Myrmecodia tuberosa* and *Pachycentria glauca*.



G. H. Addison

PLATE IV—*Ridleyara Fascad*, the first trigeneric orchid to be raised and flowered at the Singapore Botanic Gardens.



G. H. Addison

PLATE V—*Aranthera Anne Black* (*Arachnis Maggie Oei* × *Renanthera coccinea*), which flowered for the first time in 1956. It is named in honour of Lady Black, wife of H.E. the Governor of Singapore.



G. H. Addison

PLATE VI—Great Frangipanni (*Plumeria obtusa*).

VII. LABOUR

47. With four members of the daily-rated labourers transferred to the Upkeep of Herbarium vote on the 1st January, the average strength of daily-rated force at the Gardens was 74. A total of 226 man-days was lost on account of sick leave supported by certificates, while an even greater time was lost by men visiting hospital and not being certified sick or by taking their families for medical treatment. Wages amounted to \$106,619 during the year. The rates of pay remained unchanged. The daily labour force in Government House Domain averaged 56.

VIII. BUILDING AND ROADS

48. No major work was done on roads, paths and drains during the year, except for the road in the orchid enclosure which was reduced to 12 feet and new drains were constructed. The new flame gun was found suitable for controlling weeds in the paths and drains, with the exception of nut-grass (*Cyperus rotundus*). A granite retaining wall, approximately 636 feet in length, was constructed round the lower end of the lake by the Public Works Department. This is a great improvement as the grass banks were giving way in places and were unsightly and dangerous, as well as providing breeding places for mosquitoes. A path was made above the wall. At the same time the Gardens' mason re-constructed the overflow channel and built a new pipe line to drain the lake, setting it 3 feet lower than the old one, which will thus permit the lake to be more efficiently weeded. The bridge over the lake outlet was repaired and provided with *tembusu* posts and railings. Part of the lake bank on lawn *F* was faced with split nibong (*Oncosperma tigillaria*). The derelict shelter on lawn *E* was demolished as it was unsightly and serving no useful purpose.

49. The pergola on the east side near the plant house was completed in November. It was constructed of tanalised *kempas* (*Koompassia malaccensis*) and the cost, including treatment, was rather less than half that of west side which had been built of *chenghai* (*Balanocarpus heimii*) in 1955. The *chenghai* on the plant-house side was untreated, while the other half, nearer the office, had been brushed with solignum. It will be of interest to compare the durability of these timbers. By this work the plant house and environs, which are such a prominent feature of the Gardens, have been vastly improved. Work still remaining to be done there includes the construction of a water-lily pond in the centre of the *Zoysia* lawn and a new tank for mixed water plants at the south end. The pergola on the band-stand terrace collapsed during a storm in April and is now being re-built.

50. Two of the orchid seedling houses on lawn *X* below the Director's house were demolished and rebuilt inside the orchid enclosure, together with two new houses, one for orchids and the other for succulents. More benches were set up for flowering potted plants on lawn *P* within the enclosure.

IX. LIBRARY

51. Mrs. Lynas was appointed as temporary Librarian on the 1st October. With no Librarian on duty for most of the year only care and maintenance can be recorded. Hand poisoning of books and periodicals was continued throughout the year. Damage by beetles continues to a lesser extent, particularly on books still housed, through lack of space, in the herbarium and offices. Depredation among the more valuable books housed temporarily

in the new air-conditioned building was slight. About one quarter of the bound volumes and an ever-growing quantity of new literature are still improperly housed and constantly subject to insect infestation. A new library building large enough to hold all the books, and with ample space for future acquisitions, is urgently required. New books and periodicals can then pass straight into it without being contaminated. A great many volumes still await binding or re-binding. The library, which has one of the finest collections of old botanical literature in South-East Asia, contains many very valuable works and much literature which is irreplaceable. It is essential that it should be properly housed and adequately cared for.

52. Acquisitions during the year comprise 25 books and 11 periodicals by purchase and 119 periodicals and 143 reprints obtained by exchange agreements for the *Gardens' Bulletin* and *Annual Report*. Exchange arrangements now exist with 160 scientific institutions.

X. BAND CONCERTS

53. During the year twenty-two concerts were given between 5-6.15 p.m. on Sundays by the military bands on duty in Singapore. The concerts continue to be extremely popular and very large crowds have attended. The bands of the following regiments performed:—the 1st Bn. the Royal Lincolnshire Regiment; 1st Northern Rhodesian Regiment; 1st Bn. the Queen's Royal Regiment; 1st Fijian Infantry Regiment; 2nd Bn. the Royal Welch Fusiliers; 1st Bn. the King's Own Scottish Borderers; 1st King's Dragoon Guards; 15/19 the King's Royal Hussars; 1st Bn. the South Wales Borderers; 2nd Bn. Royal Australian Regiment; 1/6 Gurkha Rifles (Pipes and Drums); 2 KEO Goorkhas. The Commanding officers of these regiments and the bands are thanked for providing excellent performances, as is Major-General D. D. C. Tulloch, C.B., D.S.O., M.C., by whose courtesy they are given. Col. Collyer is thanked for arranging them.

XI. CONDUCT AND GARDENS' BY-LAWS

54. Considering the very large number of people who visit the Gardens daily, damage by the public is comparatively slight. Nevertheless, there has been an increase in petty pilfering this year, people damaged plants by carving on them, and irresponsible hooligans on bicycles continue to ignore notices and flaunt authority wherever possible. At the Chinese New Year, despite a general prohibition by the Police, the Gardens were rendered hideous by the constant detonation of fire crackers. Although it was the year of the monkey which was being ushered in, the wild monkeys in the Gardens were terrified and fled to the tops of the tallest trees in the Gardens' jungle or escaped to the comparative security of neighbouring Tyersall. For two whole days the bombardment continued during which plants were damaged, a thick litter of exploded crackers and other refuse littered the Gardens, and much inconvenience was caused to law-abiding citizens. Later in the year two men were caught trapping birds using a Straits robin as a decoy in a cage and sticks with bird line.

55. Three new Security Guards were engaged towards the end of the year and it is hoped that they will be able to restore better conduct among the small minority of visitors who mis-use the Gardens. The situation is rendered difficult, however, by the fact that new Gardens' By-Laws are urgently required and these cannot be promulgated, as the governing principal legislation, the Raffles Society Ordinance of 1878, is still under revision.

XII. GARDENS' TRAINEES

56. During the year nine trainees were accepted from the Rehabilitation Section of the Labour Department for a six months' course of training.

XIII. GOVERNMENT HOUSE DOMAIN

57. The grounds were maintained in good condition throughout the year and regular manuring, spraying and pruning was carried out. On Saturday, the 31st March, a terrific storm centred over and about the Domain. It was only of short duration, about 15 minutes, but it left a trail of devastation in its wake. No less than 14 trees were blown down, some of them very large and in no way considered dangerous, while branches were stripped off and shrubs were damaged. The biggest loss was the very fine specimen *tembusu* (*Fagraea fragrans*) near to the entrance to the Chief Secretary's drive. The other trees blown down were 6 *tembusu*, 2 *Spathodea*, 2 *Jacaranda*, 1 *Eugenia grandis*, 1 *Albizzia*, 1 *Millettia*, and 1 Clove Tree. Attempts to burn out a large hornets' nest in an oil palm in the Chief Secretary's garden resulted in setting fire to the tree and the fire brigade had to be called to put out the conflagration.

58. A fountain, using a $\frac{1}{4}$ h.p. engine, was added to the pool, which was redesigned last year in front of Government House. The hedge of *Baphia nitida* near the second gate has grown well and now forms a perfect screen. *Baphia* is not normally quick growing, but with plenty of care and ample supplies of manure, this hedge has grown up to 6 feet in just over a year. Much of the low-lying area near the main gate was levelled, so that the motor mowers can now work more efficiently. In the avenue between the two gates, the *Arfeuillea* trees are being removed as they become old and moribund and are being replaced by Madras thorn (*Pithecellobium dulce*). To add colour to this part of the Domain beds of *Bougainvillea formosa*, *B. poultoni*, *B. Beauty of Singapore* and *Stenolobium stans* were planted. Among the vegetables supplied regularly from the nursery were bayam (*Amaranthus tricolor*), long beans, brinjals, spring onions, mint, parsley, lady's fingers, lettuce, watercress and cucumbers. Orchids, *Helianthus*, Gerberas, Gladioli and Cannas are among the species grown for cut flowers. In replanting the Cannna beds throughout the domain it was found that compost in which horse manure was used produced better results than that with cow manure.

59. The Curator paid regular visits to the Governor's cottage at Changi and a certain amount of work on the garden was carried out by Government House staff. The lawns were maintained by the Public Works Department, which is officially responsible for the house and grounds.

XIV. KRANJI WAR CEMETERY

60. The Department continued to supervise the horticultural work at the Imperial War Graves Commission's Cemetery at Kranji. This entailed much extra work as it was important to get the cemetery in good condition in readiness for the official opening on the 2nd March, 1957. Following the trials with the lawn grasses *Digitaria didactyla*, *Cynodon dactylon* and *Zoysia* sp., the last named was found to be the most satisfactory. A nursery of one-eighth of an acre was laid down and when sufficient material was available, a further area of half an acre was established. By the end of the year much of the central area of the cemetery had been turfed with *Zoysia* and the remainder with *Axonopus compressus*. There are over 4,000 graves in the

cemetery, which commemorates some 28,000 people who lost their lives during the last war. The headstone borders of all plots on either side of the central avenue were planted using *Crossandra undulifolia*, *Galphimia glauca*, *Mussaenda luteola*, *Gerbera jamesonii*, *Hemigraphis colorata*, *Portulacca grandiflora* and *Chlorophytum* sp. The side tables of the approach road were planted with *Lagerstræmia speciosa* and *Filicium decipiens* and the Chinese memorial area was enclosed with a hedge of *Gardenia florida*.

XV. NATURE RESERVES

61. The Board of Trustees of the Nature Reserves held three meetings as follows:—14th March, 30th July and 9th November. Mr. Purseglove, Director of the Botanic Gardens was *ex-officio* chairman throughout the year, while Mr. M. W. F. Tweedie (Mr. C. A. Gibson-Hill acted during Mr. Tweedie's absence during vacation leave), Professor H. B. Gilliland and Mr. A. L. B. Swaine continued to serve during the period under review. Mr. Yap Pheng Geck resigned on 28th February and was replaced by Mrs. A. Ede; Mr. E. Galistan and Inche Yusof bin Ishak were appointed on 26th June to take the place of appointees of the Legislative Assembly, who resigned in 1955. A member of the staff of the City Council's Water Department was invited to attend the meetings.

62. With the employment of three new Rangers from mid-year, in addition to the Head Ranger, closer supervision was possible in the Bukit Timah and Kranji Reserves. Due to lack of a reliable boat and insufficient staff in the Pandan Mangrove Reserve, adequate supervision was not always possible in this area where thefts of timber continued on a small scale. It is hoped to purchase a new boat and to employ labourers in this reserve in 1957. A number of arrests for thefts of timber were made in the Water Catchment Area by the Rangers of the City Water Department, but on being brought to court more than half the cases were discharged and in most of the others only nominal fines were imposed, an insufficient deterrent to future felons. Seven labourers were employed throughout the year at Bukit Timah and two at Kranji maintaining paths and boundaries and patrolling. Path signs have been put up at nearly all the path intersections and a revised map of Bukit Timah was produced.

63. Steps have been taken to excise about 90 acres of the Pandan Reserve which are now farmed as prawn ponds, while a prawn pond in the south of the area will be dismantled. Despite assurances given in the past, quarrying continues at all the quarries on Bukit Timah. Although work is confined to within the quarry boundaries, the boundary path at one point has become unsafe owing to undermining. The Bukit Timah bungalow within the Nature Reserves remains crown land under the control of the Land Office. It is hoped that this may come under the control of the Nature Reserve Board so that the public may continue to enjoy one of the finest vantage points of the island.

XVI. SINGAPORE GARDENING SOCIETY

64. The Society had a successful year and membership continued at approximately 250. Several of the monthly meetings were held at the Botanic Gardens when emphasis was placed on practical instruction and demonstrations. Mr. J. W. Ewart was Secretary for the year 1955-6 and during the following year has taken on the additional duty of Treasurer. The annual flower show held at the Happy World Stadium from 13th-15th April maintained its usual high standard. Mr. G. H. Addison and Mr. J. L. Pestana

were Honorary Show Manager and Assistant Show Manager respectively and several members of the Gardens' staff acted as judges. The Gardens staged a non-competitive group of orchid hybrids and a small model garden. Government House Domain won a number of prizes in the open classes of the flowering and foliage plant sections and the prize money was distributed among the staff. Although the Gardens do not compete in the general classes, they were awarded the cups for the best *Dendrobium* in the show for *D. Neo-Hawaii* and for the new *Dendrobium* raised in Malaya for *D. Louise* var. *Elegance*.

XVII. VISITORS

65. The Gardens continue to be very popular with the public and many local inhabitants, as well as visitors to Singapore come to see them. On fine Sundays and holidays several thousands of people visit the Gardens in one day. Among the distinguished visitors from overseas who were taken round by the Director or members of the staff were:—Mr. R. R. Panje, Botanist, Sugar Cane Institute, Coimbatore, Professor J. R. A. McMillan, Dean and Professor of Agriculture, Sydney University, Mr. L. L. Forman, Royal Botanic Gardens, Kew, Dr. Anthony Steel, Principal, University College, Cardiff, Messrs. W. E. Purnell and Smid of U.N.E.S.C.O. South-East Scientific Office, Djakarta, Indonesia, Dr. C. A. Krug, Director, Instituto Agronomico, Campinas, Brazil, Mr. Anwari Dilmy, Curator of the Herbarium Bogor, Indonesia, Dr. A. J. G. H. Kostermans, Director, Forest Research Institute, Bogor, Indonesia, Mr. J. N. Macdonald, Minister for External Affairs, New Zealand, Professor G. E. Blackman, Department of Agriculture, Oxford University, Dr. F. C. Camargo, Director of Agricultural Research, Brazil, Mr. Jameel Ahmad, President, Idara Millia, Hyderabad, Deccan, India, Dr. F. R. Fosberg, Director, Pacific Vegetation Project, National Research Council, Washington, Sir Harold Parker, Ministry of Defence, London, Professor Kusnoto Setyodiwiryo, Director, Botanic Gardens of Indonesia, Dr. R. F. Raffauf, Smith Kline and French Laboratories, Philadelphia, Dr. P. R. Bell, University College, London, Mr. L. Y. Holliday, H. M. Ambassador to Laos, Dr. W. G. B. Garlick, Horticultural Experimental Station, Vineland, Ontario, Mr. G. B. Masfield, Department of Agriculture, Oxford University, H. E. Admiral Esparteiro, Governor of Macao and Madame Esparteiro, Mr. W. V. Harris, Director of the Colonial Termite Research Unit, Dr. F. R. Tubbs, Director of the East Malling Research Institute, Dr. K. G. Dodds, Director of the John Innes Horticultural Station, Professor J. D. Newton, University of Alberta, Canada, Professor R. Pichi-Sermolli, Florence University, Professor Winge, Carlsberg Laboratory, Copenhagen, Professor E. Knapp, Max Planck-Institute, Heidelberg University, Dr. T. H. Harrison, Director of Plant Quarantine, Australia, Professor R. Good, University of Hull, Professor Anton Brunn, University Copenhagen, Sir Godfrey Inch, Chairman of Cable and Wireless.

66. The Director accompanied Professor Pichi-Sermolli and Professor Good on visits to certain parts of Malaya to show them some of vegetation types to be found here. Among the botanists who worked for varying periods in the herbarium were:—Mr. G. H. S. Wood, Forest Botanist, British North Borneo; Dr. A. J. G. H. Kostermans, Director, Forest Research Institute, Bogor; Dr. P. R. Bell of University College, London; Professor Pichi-Sermolli of Florence; Mrs. B. E. G. Allen; and Professor H. B. Gilliland, Dr. A. Johnson, Dr. P. B. Tomlinson and Mr. I. Enoch of the University of Malaya.

XVIII. PUBLICATIONS

67. The first edition of the *Revised Flora* entitled *Orchids of Malaya* by R. E. Holttum published in 1953 was completely sold and a second edition is now being prepared and will be printed in 1957. The book on *Malayan Orchid Hybrids* by M. R. Henderson and G. H. Addison was published during the year by the Government Printer. It contains descriptions of over 200 hybrids which have been raised in Malaya or have been introduced from other countries, together with information on their cultivation. There are usually two plates of each orchid, one showing a spray and the other an individual flower. It is hoped that subsequent volumes will be produced, so that this valuable work may be kept up-to-date.

68. Volume XV of the *Gardens' Bulletin* was published on the 20th November. Owing to its length (383 pages) it was published as a full volume and not issued in Parts. It contains a long and important article on Dr. Furtado's revision of the *Genus Calamus in the Malayan Peninsula*. Almost sufficient copy is now to hand to publish a further volume of the *Gardens' Bulletin*.

69. The revenue from the sale of publications at the Gardens was \$830. It should be remembered that the books written by members of the Gardens' staff, past and present, and published by the Government Printer are sold direct by the Printing Office. There is a ready demand for the small pamphlets on *Malayan Garden Plants*. Three of the existing six pamphlets are out of print, having sold some 2,000 copies each, and will be reprinted. Three new pamphlets have been prepared and it is hoped that they will be published shortly.

70. The following articles and books were published by members of the staff during the year:—

- ADDISON, G. H.—New Orchid Hybrids raised and flowered Singapore. *M.A.H.A. Mag.*, XIII, 3–4.
- ADDISON, G. H.—Cactus and Succulents in Malaya. *M.A.H.A. Mag.*, XIII, 29–31, 62–63.
- ADDISON, G. H. AND HENDERSON, M. R.—*Malayan Orchid Hybrids*. Govt. Printer, Singapore.
- EWART, J. W.—Indoor Plants; Climbing Aroids. *M.A.H.A. Mag.*, XIII, 10–12.
- FURTADO, C. X.—Palmae Malesicae, XIX—The Genus *Calamus* in the Malayan Peninsula. *Gardens' Bull.*, XV, 32–264.
- FURTADO, C. X.—“Illegitimate” Names under the Rules. *Taxon*, V, 149–153.
- PURSEGLOVE, J. W.—Ridley and Rubber. *Malayan Shell*, January, 1956, 15–19.
- PURSEGLOVE, J. W.—The Vegetation of the Humid Tropics with special reference to Singapore. *In press*.
- PURSEGLOVE, J. W.—Plants for the Amateur, II *Mussaenda erythrophylla*. *In press*.
- PURSEGLOVE, J. W.—History and Functions of Botanic Gardens with special reference to Singapore. *In press*.
- SINCLAIR, J.—*Croton hirtus*, an Alien New to Malaya. *Gardens' Bull.*, XV, 1–3.
- SINCLAIR, J.—Notes on New Guinea Annonaceae, Part 1. *Gardens' Bull.* XV, 4–13.
- SINCLAIR, J.—Miscellaneous Notes on Annonaceae. *Gardens' Bull.*, XV, 14–17.
- SINCLAIR, J.—Two New Malayan Species, *Justicia johorensis* and *Petraeovitex wolfei*. *Gardens' Bull.*, XV, 18–21.
- SINCLAIR, J.—Additions to the Flora of Singapore and New Localities in Singapore for some Plants thought to be Extinct. Part II. *Gardens' Bull.* XV, 22.
- SINCLAIR, J.—A Note on *Embelia ridleyi* King and Gamble. *Gardens' Bull.* XV, 31.

APPENDIX I

STAFF OF BOTANIC GARDENS, 1956

DIVISION I-III

<i>Appointment</i>	<i>Name</i>	<i>Remarks</i>
Director	J. W. Purseglove, B.Sc., A.I.C.T.A., F.L.S.	
Assistant Director	H. M. Burkill, M.A., F.L.S.	
Keeper of Herbarium	J. Sinclair, B.Sc.	On leave from 29-2-56 to 13-10-56.
Botanist	C. X. Furtado, D.Sc. Chew Wee Lek, B.Sc.	From 1-10-56
Curators (2)	J. W. Ewart G. H. Addison	On leave from 25-1-56 to 10-3-56.
Laboratory Assistant (Special Grade)	J. L. Pestana	
Horticultural Assistant	A. G. Alphonso	Returned from U.K. (Kew) on 2-12-56.
Herbarium and Museum Assistant	Haji Mohd. Nur bin Mohd. Ghous, B.E.M.	
Laboratory Assistant	Bajuri bin Sappan	
Artist	Juraimi bin Samsuri	
Clerks	F. A. Pereira Vincent D' Rozario Miss Celine Schelkis	
Despatch Clerk	R. Raphael	
Stenographer	Miss Diana Foo	
Librarian	Mrs. L. E. Lynas, M.A.	From 1-10-56.
Junior Horticultural Assistant	Abdul Aziz bin Pakiri	
Junior Horticultural Assistant (Govt. House Domain)	Wong Siew Hang	
Storekeeper	Ismail bin Ahmad	

METEOROLOGICAL RECORDS

BOTANIC GARDENS, SINGAPORE 1956

Reading daily at 0200 hrs. G.M.T. = 9.30 a.m. Local Time

GARDEN OFFICE

Month	Total rainfall in.	Highest fall in 24 hrs. in.	No. of days rainfall	Average rainfall 1914-1956 in.	Mean Max. Temp. °F	Highest Max. Temp. °F	Mean Min. Temp. °F	Lowest Min. Temp. °F	Mean Temp. dry bulb °F	Mean Temp. wet bulb °F	Mean Relative Humidity per cent
January	11.51	3.55	16	11.64	83.8	88.5	70.5	70.2	77.6	74.4	85.7
February	5.25	1.22	15	7.59	86.8	90.0	73.6	71.0	79.5	75.8	82.7
March	4.28	1.12	11	8.56	88.7	91.8	74.5	72.0	85.8	77.3	77.8
April ..	2.68	0.63	11	8.32	86.1	92.8	75.5	73.0	82.2	77.8	80.0
May ..	8.57	4.10	16	7.38	88.8	92.0	75.8	71.5	83.3	77.5	85.1
June ..	5.67	2.45	13	6.51	88.6	92.0	75.5	73.5	82.7	77.9	82.3
July ..	13.82	4.33	18	6.24	86.8	91.8	73.9	70.5	78.4	76.3	86.8
August	8.90	1.92	23	7.39	87.3	90.5	74.1	74.1	80.1	76.8	85.6
September	12.05	3.40	19	7.78	84.1	91.0	74.5	71.0	77.0	76.5	85.6
October	4.82	1.02	20	8.12	86.4	90.0	74.7	72.5	77.8	77.0	85.4
November	19.30	3.30	21	10.39	84.6	89.0	74.2	72.0	78.9	75.7	85.6
December	8.32	1.65	18	10.08	84.0	80.2	73.0	70.5	78.4	74.4	80.0
Total or Mean ..	105.17	4.33	201	100.00	86.3	92.8	74.1	70.2	80.1	76.4	83.5

METEOROLOGICAL RECORDS

BOTANIC GARDENS, SINGAPORE 1956

Reading daily at 8.00 a.m. Local Time

ORCHID ENCLOSURE FROM 21-1-56

Month	Total Rainfall in.	Highest Fall in 24 hrs. in.	No. of days Rainfall	Mean Max. Temp. °F.	Highest Max. Temp. °F.	Mean Min. Temp. °F.	Lowest Min. Temp. °F.	Mean Temp. Dry bulb. °F.	Mean Temp. Wet bulb. °F.	Mean Relative Humidity per cent	Mean Min. Grass Temp. °F.	Mean Earth Temp. 4" °F.	Mean Earth Temp. 1' °F.	Mean Earth Temp. 4" °F.	Mean Daily hrs. Sunshine	Mean Solar Radiation °F.
January	8.48	4.00	6	83.4	89.0	71.2	69.0	71.0	72.4	96.6	69.3	78.1	80.5	82.3	..	..
February	4.92	1.22	17	87.1	91.0	72.6	70.0	74.4	73.7	96.4	70.1	80.2	82.4	82.3	..	..
March	4.29	0.96	11	88.8	91.8	73.3	71.0	75.4	74.8	96.4	72.1	81.4	83.8	83.7	6.0	..
April	2.66	0.63	11	87.8	91.5	74.5	72.2	76.7	76.1	97.0	71.3	82.4	84.7	84.3	5.1	..
May	9.52	3.79	19	85.2	91.0	74.4	71.0	77.0	76.4	96.6	72.0	80.7	83.7	84.2	3.1	..
June	4.61	2.00	13	85.4	89.0	74.2	72.0	76.6	76.1	94.2	72.4	80.9	82.8	83.5	4.5	..
July	13.73	4.00	16	84.1	89.0	73.3	71.0	75.2	74.8	97.3	71.1	79.3	81.6	82.8	4.0	136.4
August	8.67	1.84	24	85.7	88.8	73.3	71.0	75.6	75.1	97.6	71.6	80.3	82.3	82.5	4.4	140.5
September	12.20	3.00	20	85.8	89.0	73.5	71.0	76.5	75.3	94.3	71.2	80.8	83.0	82.9	4.4	139.6
October	5.07	1.00	21	85.2	89.0	73.7	71.5	76.5	75.8	96.2	71.1	81.1	83.1	83.7	3.7	135.4
November	18.12	3.53	22	83.8	88.0	73.5	71.0	75.9	75.1	96.1	67.0	80.2	81.8	83.2	2.7	131.4
December	7.98	1.49	22	85.9	89.5	72.3	70.0	74.4	73.5	94.7	69.9	78.9	82.0	82.4	4.0	140.9
Total or Mean	100.25	4.00	202	85.7	91.8	73.3	69.0	75.4	74.9	96.1	70.7	80.3	82.6	83.1	4.2	137.3

APPENDIX IV

RAINFALL RECORDS AT THE SINGAPORE BOTANIC GARDENS

1914-56 Inches

Year	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
January ..	25.40	8.89	3.79	15.43	22.37	15.32	14.36	24.80	6.96	10.61	7.99	21.47	6.49	18.32	14.29
February ..	3.93	.43	1.08	12.83	2.07	4.74	7.23	7.73	8.21	1.71	17.16	14.12	5.70	10.97	11.94
March ..	9.96	5.70	11.29	11.78	2.16	9.92	7.42	8.85	7.86	7.17	10.62	9.68	3.07	16.80	8.75
April ..	16.60	8.96	4.43	5.48	10.74	7.32	3.68	11.85	6.35	5.11	4.35	4.83	5.11	11.83	11.87
May ..	4.97	3.95	6.77	5.51	8.21	8.47	5.46	9.29	10.41	7.02	7.67	10.58	5.31	9.14	3.63
June ..	8.58	4.57	6.14	6.58	11.69	4.33	3.62	4.46	7.29	7.27	6.10	5.92	8.39	4.58	3.70
July ..	4.71	9.33	10.98	2.40	5.29	8.12	8.08	5.14	3.01	10.25	7.75	2.56	11.36	3.98	7.33
August ..	1.14	4.77	12.69	14.73	5.77	6.62	10.86	6.79	15.16	5.93	7.12	8.71	4.76	5.37	10.74
September ..	3.14	9.55	4.80	10.67	8.88	4.82	9.30	10.41	9.41	5.58	13.60	5.83	13.26	5.65	9.80
October ..	4.08	7.94	5.69	9.70	6.39	10.94	9.74	13.94	7.32	2.58	8.08	14.78	7.70	7.97	7.48
November ..	7.86	10.46	11.49	5.01	6.38	7.76	9.56	11.65	13.25	9.28	5.77	12.21	9.08	9.28	17.68
December ..	9.54	11.17	7.16	9.05	9.12	8.75	7.32	5.16	8.30	8.90	4.79	11.69	10.02	11.30	10.28
Total ..	99.91	90.72	86.31	109.17	99.07	97.11	96.63	120.07	103.53	81.41	101.00	122.38	90.25	115.19	117.04

APPENDIX IV—continued
RAINFALL RECORDS AT THE SINGAPORE BOTANIC GARDENS—continued

Year	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
January ..	5.22	3.89	11.60	6.67	11.50	22.46	12.12	7.07	10.10	10.25	7.44	2.97	15.07	10.92	7.45
February ..	8.99	4.38	4.76	6.17	6.04	7.83	5.44	1.69	6.91	8.88	5.43	7.65	6.20	3.13	12.73
March ..	9.06	5.71	7.72	6.43	10.07	13.25	9.57	12.82	4.57	8.80	4.45	3.87	5.25	12.57	8.34
April ..	2.51	14.50	7.38	5.94	5.55	5.91	4.79	6.65	9.52	7.64	7.59	8.46	7.63	14.71	9.90
May ..	8.67	10.52	9.07	13.72	5.16	7.69	8.34	7.60	8.15	6.65	4.54	3.32	8.12	6.63	5.67
June ..	8.11	12.53	8.98	7.32	7.00	4.38	8.78	3.28	3.02	8.55	5.20	14.94	1.76	5.11	6.69
July ..	2.15	1.89	7.08	11.70	9.85	11.68	2.73	4.62	2.61	2.14	4.29	3.49	2.58	6.43	4.08
August ..	7.97	1.13	6.21	1.93	7.38	12.14	3.02	4.02	4.66	6.93	15.90	11.46	5.04	8.19	5.23
September	9.04	7.21	10.93	8.66	7.93	3.66	3.67	1.71	7.55	8.34	9.56	4.62	2.83	6.67	10.15
October ..	8.23	9.01	6.89	3.60	9.80	10.52	4.62	10.37	6.76	7.03	8.66	4.72	3.82	19.57	8.92
November	11.61	10.82	13.26	6.78	12.08	12.89	11.87	14.84	10.62	6.25	9.73	8.66	9.12	10.82	7.89
December	4.49	10.08	10.86	4.47	6.70	2.52	14.47	10.27	13.36	9.20	13.78	11.89	9.54	22.01	7.57
Total	86.05	91.67	104.74	83.39	99.06	114.93	89.42	84.94	87.84	90.66	96.57	86.05	76.96	126.76	94.62

APPENDIX IV—continued
RAINFALL RECORDS AT THE SINGAPORE BOTANIC GARDENS—continued

Year	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	Average 1914-56
January	2.50	5.22	5.69	11.24	17.77	4.82	6.94	22.49	14.19	5.50	7.62	23.83	11.51	11.64
February	11.12	6.50	15.01	12.48	10.38	5.26	3.74	4.44	12.65	16.53	9.39	3.16	5.25	7.59
March	3.48	18.52	11.01	17.12	14.68	3.85	8.98	3.96	11.85	7.68	5.81	3.27	4.28	8.56
April	6.83	11.75	11.71	8.83	6.64	10.49	11.09	12.64	9.46	13.07	6.89	8.46	2.68	8.32
May	6.05	5.35	11.79	5.24	11.98	10.93	7.09	6.63	7.11	5.87	5.41	5.02	8.57	7.38
June	4.42	4.49	6.82	7.54	7.53	10.36	5.19	3.08	5.59	2.66	13.04	4.47	5.67	6.51
July	4.23	6.87	1.55	5.04	14.88	2.79	9.19	10.82	6.70	4.05	7.49	3.14	13.82	6.24
August	7.12	9.47	4.54	6.85	3.48	2.33	12.64	4.25	9.63	7.03	8.87	10.09	8.90	7.39
September	11.71	6.63	16.80	10.83	6.20	5.18	6.01	4.39	5.75	8.32	5.64	7.82	12.05	7.78
October	5.65	11.60	7.77	6.83	4.16	11.15	10.44	5.62	12.79	2.90	10.75	7.79	4.82	8.12
November	11.85	8.34	10.98	8.34	12.67	14.42	15.53	8.54	9.62	6.78	9.31	7.17	19.30	10.39
December	6.98	9.45	11.43	17.93	14.06	10.79	5.01	2.01	9.55	8.06	26.77	14.13	8.32	10.08
Total	81.94	104.19	120.10	118.27	124.43	92.37	101.85	88.87	114.89	88.45	116.99	98.35	105.17	100.00

INSTITUTIONS AND PRIVATE COLLECTORS FROM WHOM PLANTS
AND SEEDS WERE RECEIVED IN 1956

Australia	..	..	Botanic Gardens, Adelaide; Mr. E. Pulloch, Parkes, N.S. Wales.
Austria	..	..	University Botanic Gardens, Vindobon.
Bahamas	..	..	Mrs. A. Langlois, Nassau.
Belgium	..	..	Botanic Gardens, Antwerp.
Canada	..	..	Botanic Gardens, Montreal.
Ceylon	..	..	Royal Botanic Gardens, Perideniya.
Denmark	..	..	Botanic Gardens, Copenhagen.
Finland	..	..	University Botanic Gardens, Turku.
France	..	..	Botanic Gardens, Besancon; Ministry of Agriculture, Antibes.
Germany	..	..	Botanic Gardens of Frankfurt, Hamburg Essen, Halle, Westfalen, Kassel, Darmstadt and Jena, Mr. Robert Blossfeld, Lubeck.
Gold Coast	..	..	University College, Achimota.
Hawaii	..	..	Mr. Wm. Kirch, Honolulu; Mr. J. W. Gregg, Koloa Kauai.
Holland	..	..	Botanic Gardens of Amsterdam, Utrecht and Leiden; Institute of Horticultural Plant Breeding, Wageningen.
Hong Kong	..	..	Urban Services Department.
India	..	..	Tocklai Experimental Station, Assam.
Indo-China	..	..	Mr. Holliday, British Embassy, Laos.
Italy	..	..	Universities of Modena and Padova.
Japan	..	..	Onomichi Botanic Gardens, Hiroshima; Izu Experimental Station of Medicinal Plants, Shizuoka-ken.
Malaya	..	..	Singapore Gardening Society; Department of Agriculture, Cameron Highlands; Mr. E. F. Allen, Kuala Lumpur; Forest Research Institute, Kepong; Mr. Lee Kim Hong, Singapore; Botanic Gardens, Penang; Mrs. J. B. Pickering, Singapore; Dr. Drenth, Singapore; Department of Agriculture, Kuala Lumpur; Mr. D. C. Doo, Singapore; Coronation Nursery, Singapore; University of Malaya; Mrs. E. I. Henton, Singapore; Mrs. R. Scott, Singapore; Mr. Le Doux, Johore; Dr. J. Dore, Kuala Lumpur; Mrs. C. J. E. Jarvis, Singapore; Dr. R. J. Grove-White, Singapore; Mr. Tan Siew Kuah, Singapore; Dr. Yeo Bock Choon, Johore; Palas Gardens, Cameron Highlands; Mr. M. E. L. Robey, Malacca; Mr. A. J. Braga, Singapore; Major-General Tulloch, Singapore; Dr. Wong Lai Hock, Singapore; Miss M. A. Buxton, Singapore; Mr. Quek, Singapore; Professor H. B. Gilliland, University of Malaya.
Mauritius	..	..	Botanic Gardens, Port Louis.
New Guinea	..	..	Forest Department, Lae; Mr. Elsworthy.
Poland	..	..	Panstwowy Instytut Nonkowy, Poznan.
Portugal	..	..	Coimbra University; Estacua Agronomica Nacional, Sacavim; Jardim Museu Agricola do Ultramar; Botanic Gardens, Lisbon.
Sarawak	..	..	Forest Department, Kuching.
Seychelle Islands	..	..	Mr. C. S. Brisbane.
South Africa	..	..	University of Pretoria; Distin's Seeds, Johannesburg; Mr. L. B. Holland, Zululand; National Botanic Gardens, Kirstenbosch.
Sweden	..	..	University Botanic Gardens of Gottingen and Uppsala; Stockholm Botanic Gardens.
Thailand	..	..	Major-General Rasme Rasnival, Bangkok.
Trinidad	..	..	Imperial College of Tropical Agriculture.
United Kingdom	..	..	University of St. Andrews, Scotland; London University; Royal Botanic Gardens, Kew.
U.S. of America	..	..	U.S. Plant Introduction Gardens, Florida; Mr. De Leon, Florida; Mr. Edwin Johnson, Florida; Department of Agriculture, Washington D.C.
Yugoslavia	..	..	Botanic Gardens, Zagreb.

INSTITUTIONS AND PRIVATE COLLECTORS TO WHOM PLANTS
AND SEEDS WERE SENT IN 1956

Australia	..	..	Botanic Gardens, Adelaide.
Bahamas	..	..	Mrs. V. Horan, Nassau; Mrs. A. Langlois, Nassau.
Brazil	..	..	Botanic Gardens of Rio de Janeiro and Para.
China	..	..	Botanic Gardens, Taipei, Taiwan.
Czechoslovakia	..	..	Botanic Gardens of Academy of Science, Kosice.
Denmark	..	..	University of Copenhagen.
Egypt	..	..	Middle East Botanic Station, El-Saft.
Fiji	..	..	Department of Forestry; Department of Agriculture.
France	..	..	The Leonina Experimental Station, Beaulieu.
Germany	..	..	University Botanic Gardens, Jena.
Holland	..	..	Laboratory of Technical Botany, Delft, Mr. A. Orloff, Alsmeer.
Hungary	..	..	Botanic Gardens, Szentes.
India	..	..	Delhi University; Fruit Research Station, Saharanpur; National Botanic Gardens, Lucknow; Mr. S. Hedayetullah, Decca; Mr. Percy-Lancaster, New Delhi.
Indonesia	..	..	Botanic Gardens, Bogor.
Japan	..	..	National Kyushu Regional Agricultural Experimental Station, Kagoshima; Miyakijima Weather Station; Eisei Shikenjo, Izu Bunjo, Shizuoka-ken; Osaka Botanic Gardens.
Kenya	..	..	Graham Bell Ltd., Nairobi.
Malaya	..	..	Botanic Gardens, Penang; Department of Agriculture, Kuala Lumpur; and many private collectors.
New Guinea	..	..	Department of Fisheries, Port Moresby.
Poland	..	..	Polish Academy of Science, Crackow.
Sarawak	..	..	Forest Department, Kuching.
Seychelle Islands	..	..	Mr. C. S. Brisbane.
South Africa	..	..	Mr. E. H. Stein, Transvaal.
Thailand	..	..	Mr. C. Marong, Bangkok.
Trinidad	..	..	Imperial College of Agriculture.
Uganda	..	..	Department of Agriculture.
U.S. of America	..	..	Mr. E. Johnston, Florida; Mrs. Adams, Fairchild Tropical Gardens, Florida; Mr. Van der Laan, Florida; Mr. E. Menninger, Florida; Mr. F. W. Howe, New York; Mr. D. E. Wolf, New Jersey; Mr. Harrison Yacum, Pennsylvania.

